

Schwarz-1, Henry

From: Palmer, Michael J [michael.j.palmer@usago.ksc.nasa.gov]
Sent: Wednesday, January 15, 2003 9:04 AM
To: Douglas, Tamara A
Subject: mps-1551



MPS-2-28.pdf

1/13/03 08:03:00 PM

Official

PR MPS-2-28-1551

SUSPECT BSTRA ASSEMBLY

Element/End Item: **OV102**

Flow/Usage: **FLIGHT 28/STS107**

Facility: **OPF**

Design Center Concurrence: **JSC**

Category:

OPR: **MPS**

TTL ORG: **SE**

**This document does not contain
hazardous operations.**

PR MPS-2-28-1551

Approval Record

SUSPECT BSTRA ASSEMBLY

Technical Contact: F. Tomimbang Phone: 1-3370

Category II TOP Only

This Approval Record is for all Operation No(s) listed below:

Initial Released Operations: 10

Added Operations: _____

Deleted Operations: _____

Replaced Operations: _____

Change Index Added _____

Comments: _____

Check Family Type: In Family[] Out of Family[X] NMA[]

[illegible]

1/13/03 08:03:00 PM

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The following signatures are for the Deferral disposition only.

Organization	Name (Printed)	Name (Signature)	Date
OPR-MR			
NASA-SE			
ORB-LSS			
QE			

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PR MPS-2-28-1551

PMRB Concurrence with the Disposition per rationale on page(s) _____

Organization	Name (Printed)	Name (Signature)	Date
Shuttle Engineering, KSC			
Process Engineering, KSC, PMRB Chairman			
LSS Engineering			
SSP Element Project Office KSC			
LSS System Integration			
SSP Engineering Integration KSC			
S & MA			
Chief, MA Engineering, KSC			
PMRB Chairman Secretary			

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1.0 INFORMATION

1.3 Operations List

Operation		Shop/ Cntl Rm Console	OPR	Haz (Y/N)	Duration (Hrs)
No.	Title				
10	Deferral	AFT/ NA	MPS	N	30

2.0 SAFETY INFORMATION

2.4 Reference Safety Documentation

Number	Rev	Title
KHB 1710.2	LI	KSC Safety Practices Handbook
GSOP 5400	LI	Ground Safety Operating Procedure

3.0 STAGING REQUIREMENTS

4.0 PLANNING REQUIREMENTS

OIR Required Yes [], No [X]

Predecessors:

Successors:

Configuration Required:

5.0 CONFIGURATION ACCOUNTING AND VERIFICATION

OPERATION 10 Deferral

Shop: AFT

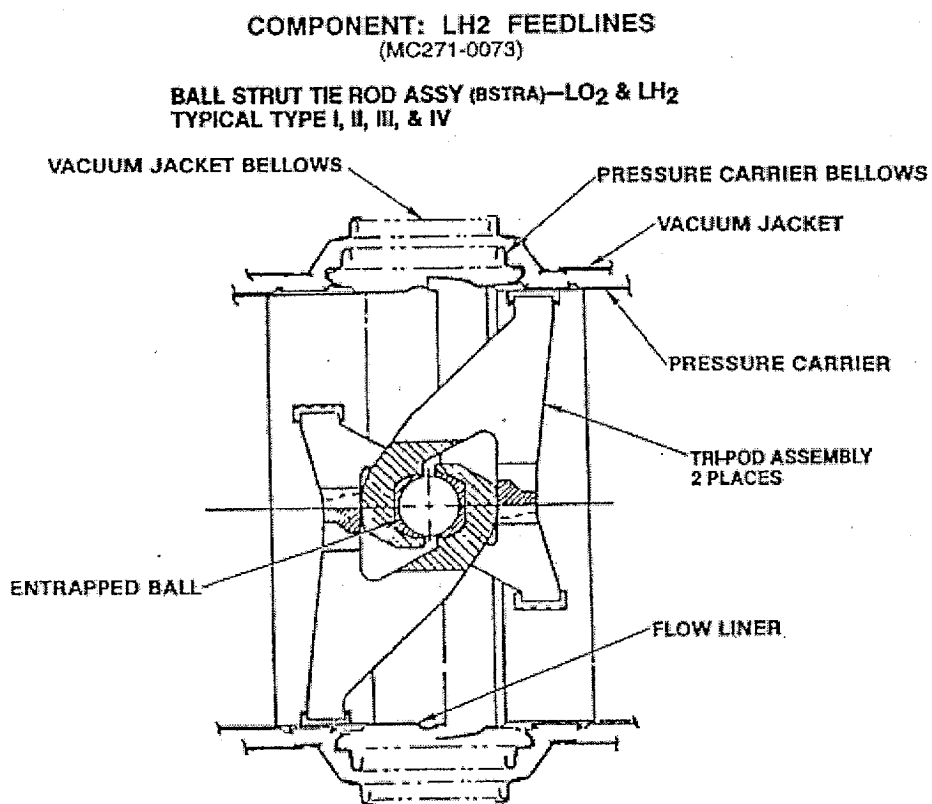
Cntrl Rm Console: NA

OPR: MPS

Zone: 330

Hazard (Y/N): N

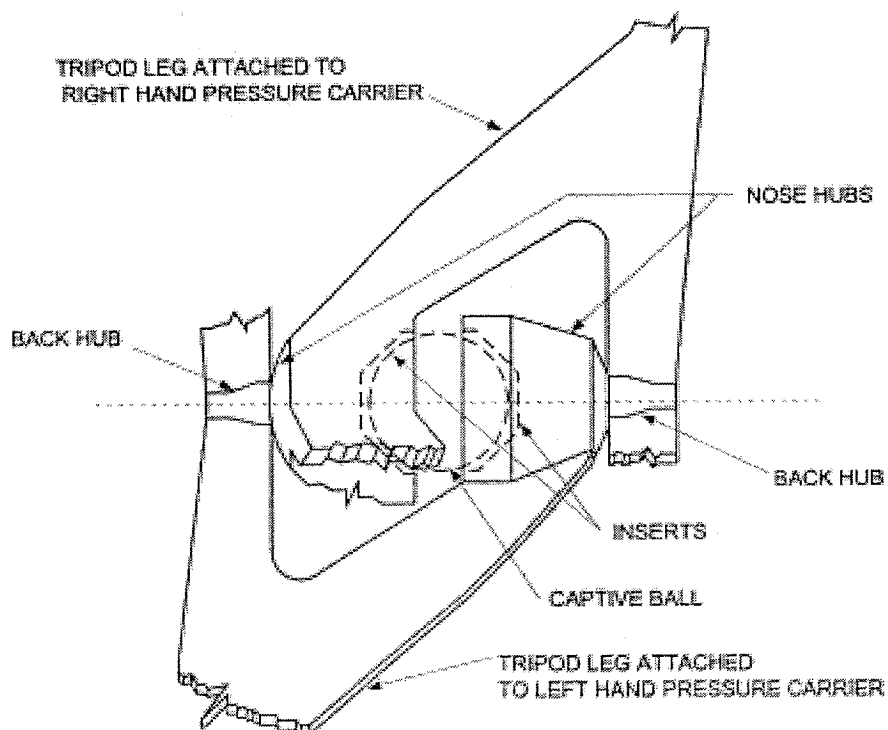
Duration (Hrs): 30



 **Rockwell** Aerospace

Figure 10-1 - Typical Ball-Strut-Tie-Rod-Assembly (BSTRA)
(For Reference Only)

7-7-99



LEFT AND RIGHT TRIPODS ROTATE ABOUT
THE CENTER OF THE CAPTIVE BALL.

INTERLOCKING ASSEMBLY OF TRIPODS
REACTS AXIAL TENSION AND COMPRESSION
BY CREATING CONTACT BETWEEN TRIPOD
ELEMENTS AND THE CAPTIVE BALL.

LATERAL LOADING ON THE BALL MAINTAINS
RADIAL ALIGNMENT.

V1009_01-F-001

Figure 10-2 - Closeup of Captive Ball and Hubs
(For Reference Only)

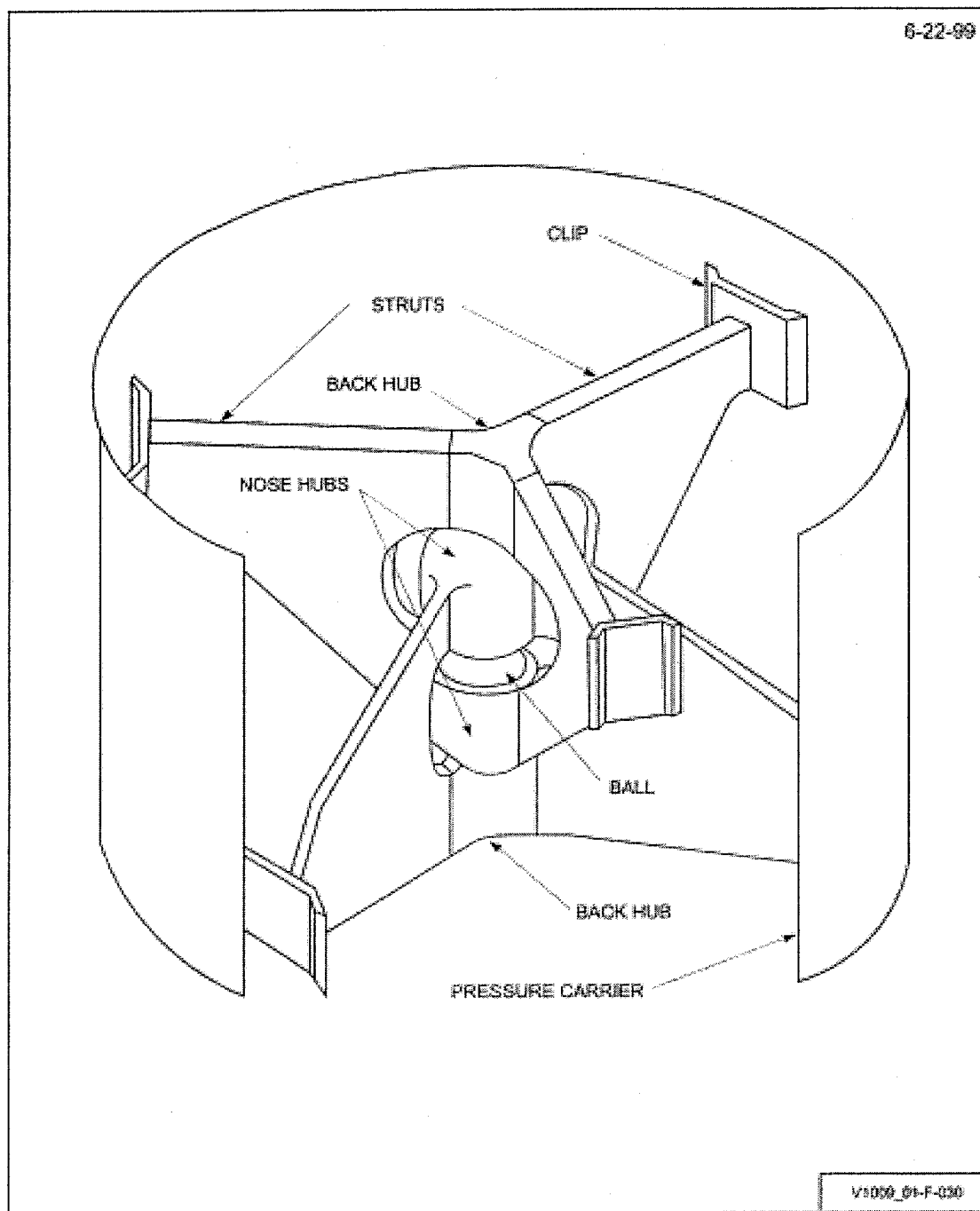


Figure 10-3 - Three Dimensional View; Ball-Strut-Tie-Rod-Assembly (BSTRA)
(For Reference Only)

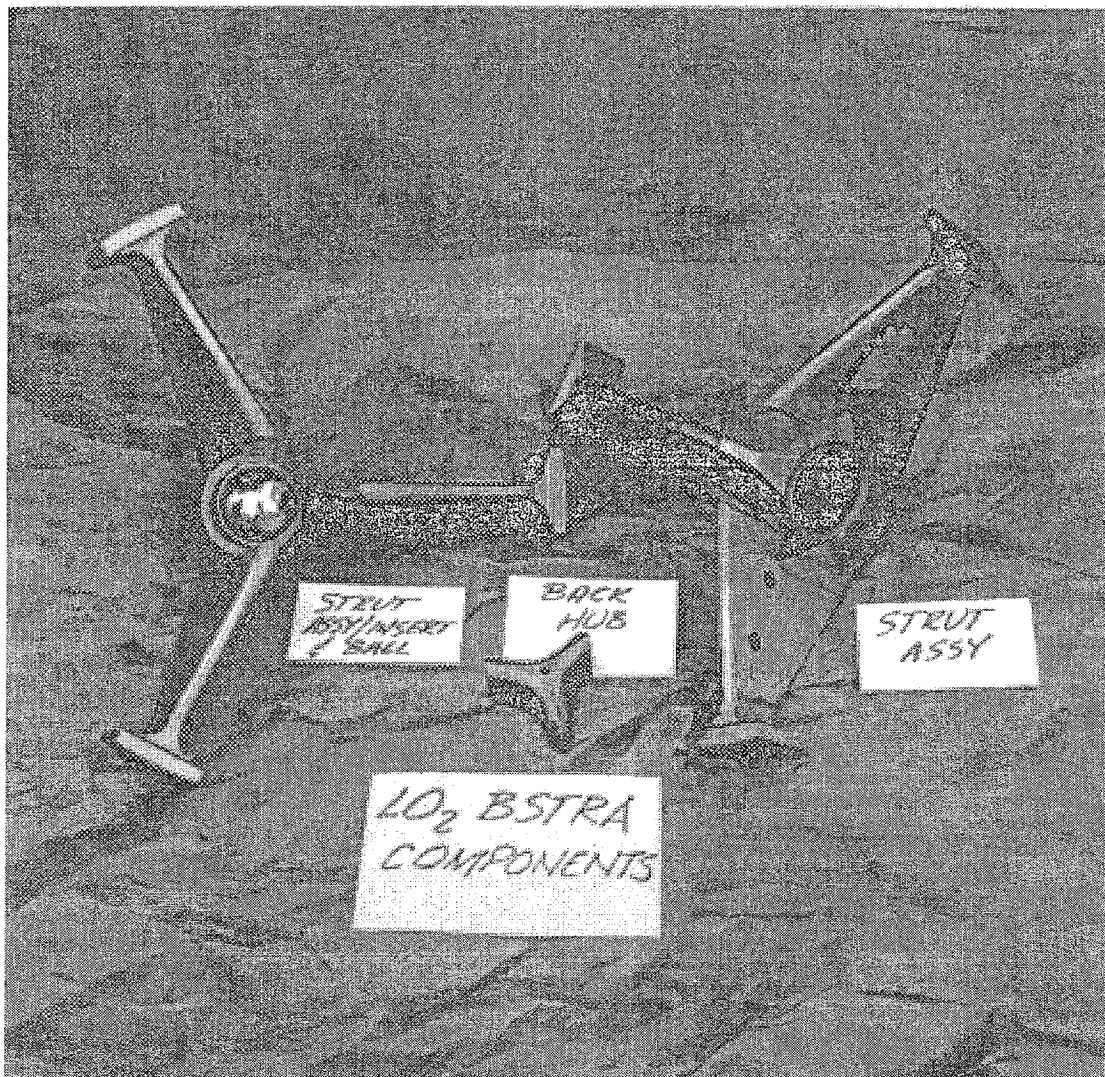


Figure 10-4 - Ball-Strut-Tie-Rod-Assembly (BSTRA) Components
(For Reference Only)



Figure 10-5 - Cracked Ball on OV103
(For Reference Only)

ACTION REQUESTED - RESTRICTED LIFE DEFERRED "USE AS IS"Ref. Item # 1

Recommend Deferral approval, acceptance of disposition for Restricted Life "Use as is".

[X] One Flight, [] Future Flight _____.

Rationale:

During OV103 OMDP borescope inspections of the Ball-Strut-Tie-Rod-Assemblies (BSTRA), a crack was found in the ball LO₂ 17" feedline aft BSTRA. Consequently, suspect PR's were initiated on all orbiters. Subsequent borescope inspections of all accessible areas of the BSTRA balls in OV103, OV104, and OV105 found no other indications. OV102 could not perform these inspections at the Pad, however, the same video borescope inspections were performed prior to its last flight (STS-109) at Palmdale. No anomalies were noted during the inspection and a review of the videotape reveals no apparent indications.

The BSTRA is an internal support mechanism for the bellows assemblies of the LO₂ and LH₂ 17 inch and 12 inch feedlines. Each 17 inch feedline has three BSTRA assemblies, each 12 inch feedline has two. Reference figures 10-1 through 10-5 for hardware description.

Upon discovery of the crack, testing to better understand the material properties of the BSTRA balls was accomplished. Tests included subjecting BSTRA balls to cryogenic conditions in conjunction with load forces. The environments that the test specimens were subjected to were extreme when compared to the flight environment the balls typically are exposed to (i.e.: bare balls thermally shocked at cryogenic temperatures, dynamic portion of each loading cycle represents approximately 4X actual environment, higher thermal gradients). The following conclusions have been drawn from recent testing: cracks arrest, BSTRA ball cracks do not limit functionality, many features (islands, branching, fines, and FOD) were observed, and no FOD greater than 400 micron equivalent size has been produced.

M&P Team has observed metallurgical characteristics in the test specimens and concluded that the indication of the jagged nature of the fracture provides a locking feature to preclude large island liberation. The size of the particulate generated has been evaluated by Rocketdyne and is within operational experience and design limits of the SSME. Particulate of the type and amount seen during testing could readily be ingested by the engine and is not a concern.

The model developed by the Stress Team agrees with test, analysis, and observations and substantiates the conservatism of testing.

Based on Boeing design, USA, Boeing and NASA test and analysis, and the absence of indications from the review of the most recent OMDP borescope inspection, OV102 has been approved for one flight by the Space Shuttle Program Manager. This PR will be deferred to flight 29 of OV102 when further inspections will take place.

This deferral action does not invalidate the basis for certification.

This deferral action does not impact the Critical Items List (CIL) retention rationale or hazard controls.

10-1

QE

Route this PR to PMRB for approval.

QE:_____

10-2

OQCV

Transfer this PR to OV-102, Flight 29.

WC:_____

Post flight disposition summary

Post flight disposition will include a thorough inspection of the BSTRA balls using video borescope. If access permits, a ball manipulation tool in conjunction with the GSE struts to rotate the balls within the BSTRA's will be used.

*** End of Operation 10 ***